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ONCE A TYPHOID CARRIER, ALWAYS A TYPHOID CARRIER

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The part played in the incidence of typhoid fever in Massachusetts by typhoid bacilli carriers is unknown, but the number of typhoid bacilli carriers found each year is increasing, although typhoid cases reported annually in the state are decreasing in number.

The axiom of "once a carrier, always a carrier," is a good one for health officials to stand by. A series of negative fecal and urinary examinations for the typhoid bacillus should mean nothing to a board of health who are safeguarding the public health, if typhoid bacilli have been found in the excreta of a person three months or more after having had typhoid fever. It is true that occasionally the removal of a gallbladder results in negative findings. However, the mere fact that it is not true in all instances indicates that there is a chance that the bacilli are lurking in other places than the removed gallbladder, and that the person may remain a carrier indefinitely.

The small number of typhoid cases reported in recent years makes the investigation of individual cases easier than formerly when the number of cases was twice as large. A more careful investigation of the individual case for the purpose of locating the source of infection is needed in order to lower the existing morbidity and mortality rate.

Intensive work in studying individual typhoid fever cases and obtaining an epidemiologic case record for each case was started in Massachusetts in 1917. These investigations have been made by the local boards of health, state district health officers, nursing assistants and the epidemiologist. By careful questioning, the data on the case records have proved of great value in most instances, although there is an opportunity for more conscientious gathering of detailed information on the case records by some boards of health.

From the case records of the past three years, it is evident that more than half of the typhoid fever cases in Massachusetts are due to carriers. The clinical case caused 13.2% of our typhoid cases in 1918 and 1919. These far too numerous secondary cases were caused in households because physicians did not insist on administering the typhoid-paratyphoid vaccine to contacts.

Received for publication May 1, 1920.

In the search for carriers it has been surprising to find the number of carriers who have no recollection of ever having had typhoid fever. This is particularly true of older persons. However, in 1919, of the 13 carriers found, only 3 gave a negative typhoid history.

Before the carrier campaign was started, it was rather unusual to find a carrier unless he was involved in an outbreak of typhoid, but this has changed, for housewives are now proving to be the most common carriers found and usually cause only one or two cases. We know that typhoid carriers caused 132 cases or 7.9% of the 1,665 typhoid fever cases studied in the state in 1918 and 1919. In addition many cases and small outbreaks were suspected of being caused by carriers, but were not proved.

The first carrier located in Massachusetts was found in 1910 and the "carrier list" now contains 51 known carriers which are given in the accompanying table.

TYPHOID CASES INFECTED BY CARRIERS

The 51 carriers were apparently responsible for 493 cases of typhoid fever. Of the 51 carriers, 21, or 41%, transmitted the infection to others by milk and 18, or 35%, were food handlers, infecting others probably by food. The remaining 12 carriers, or 24%, were in such occupations that they could have caused the cases associated with them, by food or contact.

The intermittent nature of the carrier danger is manifest in several carriers. For instance, carrier 42 caused no known cases in 1909, 1910, or the period 1914 to 1918 inclusive, yet in 1919 there were 29 cases on his milk route and for the first time, typhoid bacilli were isolated in his excreta. Similarly, carriers 8, 21 and 29 show the same peculiarity and indicate the grave menace a carrier is during his lifetime.

MILK INFECTION MINIMIZED

There would be practically no milk outbreaks of typhoid fever if we could locate the carrier before the milk was infected. For this reason it would seem advisable to have all milk handlers submit to at least three agglutination tests, fecal and urine bacteriologic examinations, even though they give no history of having had typhoid fever.

The hunt for carriers, from a financial or health standpoint, would certainly pay from an economic point of view. Once a survey of employees was completed, it would be little trouble to keep the new employees checked up.

TABLE 1

Typhoid Bacilli Carriers in Massachusetts

Carrier	Occupation	Year of Typhoid Illness	Years After Illness Before First Known Case	Cases Apparently Due to Carriers	
				Year	Cases
1	Maid..........	No typhoid history; B. typhosus isolated in feces, 1915	..	1915	6
2	Milk handler..	No typhoid history; B. typhosus isolated in 1916.......	..	1916	9
3	Housewife.....	1914; B. typhosus isolated in feces, 1917..............	..	....	..
4	Milk handler..	1870; B. typhosus isolated in feces, 1915..............	45	1914	56
				1915	10
5	Waitress......	1914; B. typhosus isolated in feces, 1916..............	3	1916	1
6	Waitress......	No typhoid history; B. typhosus isolated in feces, 1916	..	....	..
7	Milk handler..	No typhoid history; B. typhosus isolated in feces, 1916	..	1916	5
8	Milk handler..	"Intestinal grippe" 1896; B. typhosus isolated in feces, 1916	3?	1899	1
				1911	1
				1912	1
				1915	1
				1916	1
9	Student.......	October, 1915; B. typhosus isolated in feces, 1917.......	2	1916	2
				1917	2
10	Milk handler..	No typhoid history; B. typhosus isolated in feces, 1916	..	....	..
11	Food handler.	No typhoid history; B. typhosus isolated in feces, 1915	..	1915	22
12	Cook..........	No typhoid history; B. typhosus isolated in urine, 1916	..	....	..
13	Nurse..........	No typhoid history; B. typhosus isolated in feces, 191	..	1917	1
14	Milk handler..	No typhoid history; B. typhosus isolated in feces, 191	..	1911-12	3
15	Housewife.....	1914; B. typhosus isolated in feces, 1915..............	1	1915	1
16	Waitress......	1906; B. typhosus isolated in feces, 1910..............	4	1909	5
17	Milk handler..	1894; B. typhosus isolated in feces, 1910..............	8	1902	21
				1903	15
				1904	4
				1905	9
				1906	6
18	Milk handler..	No typhoid history; B. typhosus isolated in feces, 191	..	1913	9
19	Milk handler..	No typhoid history; B. typhosus isolated in feces, 191	..	1913	61
20	Chairmaker...	1916; B. typhosus isolated in 1916......................	..	....	..
21	Milk handler..	No typhoid history; B. typhosus isolated in feces, 191	..	1915	5
				1917	80
22	Cook..........	No typhoid history; B. typhosus isolated in feces, 191	..	1916	5
				1917	1
23	Student.......	1917; B. typhosus isolated in feces, 1917..............	6 mo.	1917	1
24	Milk handler..	No typhoid history; B. typhosus isolated in feces, 191	..	1917	4
25	Housewife.....	1913; B. typhosus isolated in feces, 1917..............	4	1917	1
26	Unknown......	July, 1917; B. typhosus isolated in feces, Jan., 1918....	..	....	..
27	Laborer.......	June, 1917; B. typhosus isolated in urine, Nov., 1917....	5 mo.	1917	2
28	Iceman........	Sept., 1915; B. typhosus isolated in Dec., 1915..........	3 mo.	1915	2
29	Milk handler..	1909; B. typhosus isolated in 1918......................	9	1911	10
				1914	2
				1915	1
				1918	2
30	Maid..........	1895; B. typhosus isolated in 1918......................	23	1918	1
31	Milk handler.	1917; B. typhosus isolated in feces, 1918..............	1	1918	6
32	Milk handler.	No typhoid history; B. typhosus isolated in urine, Aug., 1918	1	1918	2
33	Milk handler..	No typhoid history; B. typhosus isolated in feces, Sept., 1918	1	1918	3
34	Laborer.......	1916; B. typhosus isolated in feces, 1918..............	2	1918	1
35	Milk handler.	No typhoid history; B. typhosus isolated in feces. 1919	..	1919	8
36	Student......	Feb., 1919; B. typhosus isolated in feces, Aug., 1919....	6 mo.	1919	1
37	Milk handler.	1913; B. typhosus isolated in urine, 1919..............	6	1919	8 ?
38	Maid.........	1914; B. typhosus isolated in feces, 1919..............	5	1919	1
39	Milk handler.	No typhoid history; B. typhosus isolated in feces, 1919; found in same outbreak as Carrier 37	..	1919	8
40	Mechanic......	1918; B. typhosus isolated in feces in June, 1919........	1	1919	1
41	Milk handler.	1898; B. typhosus isolated in feces, 1918..............	20	1918	6
42	Milk handler.	1906; B. typhosus isolated in feces, 1919..............	13	1907	5
				1908	2
				1911	2
				1912	2
				1913	33
				1919	29
43	Milk handler	1915; B. typhosus isolated in feces, 1919; this carrier caused other deaths in N. H.	4	1919	3
44	Housewife.....	No typhoid history; B. typhosus isolated in feces, 1919	..	1918	2
				1919	2
45	Housewife.....	1901; B. typhosus isolated in feces, 1919..............	18	1919	1
46	Housewife.....	Oct., 1918; B. typhosus isolated in feces, Feb., 1919.....	4 mo.	1919	1
47	Manager......	1903; B. typhosus isolated in feces, 1919..............	16	1919	1
48	Cook..........	1915; B. typhosus isolated in feces, 1919..............	4	1919	1
49	Maid..........	1915; B. typhosus isolated in feces, 1920..............	5	1919	1
50	Housewife.....	1913; B. typhosus isolated in feces, 1920..............	7	1920	1
51	Caretaker.....	Nov., 1919; B. typhosus isolated in feces, March, 1920..	..	....	..

PASTEURIZATION

Pasteurization has undoubtedly prevented outbreaks of disease, but an outbreak of septic sore throat occurred in Massachusetts on a route on which pasteurized milk was supplied, because the milk was infected after pasteurization. There is an opportunity for infection in the process of capping the bottles and it would seem desirable to have employees doing this work examined in order to discover whether they are carriers.

TABLE 2

SUMMARY OF CARRIERS AND CASES THEY INFECTED

	Number of Carriers	Typhoid Cases
Milk handlers	21	426
Food handlers		
Cooks	4	29
Maids	7	15
Housewives	7	9
Nurses	1	1
Icemen	1	2
Nonfood handlers	10	11
Total	51	493

OCCUPATIONS

It is rather startling to find typhoid carriers among nurses, but two were found. One who handled milk caused 6 cases and the other infected her patient. In recent years it is the houseworker, the maid, waitress, cook or wife who causes the carrier cases and it is a good indication of the activity of the local boards of health along the line of communicable disease prevention that such carriers have been found.

LENGTH OF CARRIER STATE

The question is often asked in regard to the length of time a person may be a carrier and the only answer is 'always."

One carrier had typhoid 44 years prior to the first case traced to him, and others 20, 18, 16 years and shorter periods.

The time interval was not obtained for all carriers because of the inability of the carrier to supply reliable data.

RELEASE CULTURES IN CLINICAL CASES

A system of examining the urine and feces of each typhoid patient at hospitals and requiring three negative findings on three specimens taken at least 48 hours apart before discharging the patient, brought to light three carriers in two hospitals during 1918 and 1919.

This method of "release cultures" should prove of the greatest value in locating carriers before they cause infection rather than after, as does the present method.

CHECKING OF CARRIERS

At four-month intervals investigations are made to determine whether each typhoid carrier in the state has "kept faith" and is not engaged in an occupation in which food is handled or in an occupation whereby the public health would be endangered. Up to the present time, no typhoid carriers have been known to have caused an infection, since being proved carriers.

LABORATORY PROCEDURE

The bacteriologic laboratory distributes a double mailing case enclosing a rubber stoppered test tube containing 30% glycerol in 0.6% sodium chlorid solution. This outfit is used for sending specimens of feces and urine to the laboratory. The amount of feces sent is, as a rule, about one-fifth of the total volume of the emulsion and the amount of urine about one-half. This outfit was designed primarily for feces specimens as the majority of typhoid carriers are fecal carriers. The glycerol solution recommended by Teague and Clurman has been found most valuable for the preservation of specimens delayed in transit.

As soon as the specimen arrives at the laboratory it is streaked with a platinum loop on large (13 cm.) plates of Endo's medium, freshly prepared each day. The eosin-methylene blue agar of Holt-Harris and Teague is also used. For specimens of feces two plates of each medium are used and two or three loopfuls of the feces suspension are used to a plate. For urine, approximately 20 loopfuls to a plate are used.

After 18-24 hours' incubation at body temperature, 6 or more colonies resembling B. typhosus are fished and each inoculated into 2 c c nutrient broth. Should no suspicious colonies be seen but many colonies of the colon group, fresh plates are streaked with the specimen, then 24 hours older. It has been found that glycerol inhibits colon bacilli more than typhoid and that an older specimen showing fewer colon colonies on a plate occasionally gives positive results because there is less overgrowth of the typhoid bacilli with other organisms.

After 4-6 hours' incubation at 37 C., the broth cultures are examined in hanging drop for motile bacilli resembling typhoid. If any are found, they are mixed with a typhoid agglutinating serum, in appropriate dilution, and examined within an hour for agglutination. If one of the cultures is completely agglutinated it is inoculated into dextrose and lactose broths in fermentation tubes. A culture forming acid in dextrose broth and no gas in either sugar broth within 48 hours is reported as B. typhosus.